

Compositional Variability of Aviation Turbine Kerosene as Determined with the Advanced Distillation Curve Method

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Aviation turbine kerosenes (jet fuels) are extremely complex mixtures of hydrocarbons derived from petroleum through refinement processes and contain many of the possible structural isomers for the hydrocarbon composition ranging from 6-carbon to 18-carbon hydrocarbons. Gas turbine fuels, commercial and military, are purchased by specifications defining the physical properties of the products. These specifications, such as ASTM D1655 and MIL-DTL-83133, permit broad variation in chemical composition to ensure supply. One way to begin to define and hopefully to later model differences within fuel types is to analyze the distillation curves. The advanced distillation curve method offers significant improvements over previous approaches, such as ASTM D-86, and can be applied to any complex fluid. It features (1) a composition-explicit data channel for each distillate fraction (for both qualitative and quantitative analyses), (2) temperature measurements that are true thermodynamic state points that can be modeled with an equation of state (EOS), (3) temperature, volume, and pressure measurements of low uncertainty suitable for EOS development, (4) consistency with a century of historical data, (5) an assessment of the energy content of each distillate fraction, (6) trace chemical analysis of each distillate fraction, and (7) corrosivity assessment of each distillate fraction. In this presentation, we report the application of the advanced distillation-curve approach to the gas turbine fuels Jet-A, JP-8, and JP-5, in order to obtain information about the variability of gas turbine fuels. We also compare our results with a recent thermophysical property model implemented in the REFPROP computer program.